

6.1 SEWER SYSTEM DESIGN

6.1.1 General Comments

This section provides guidance and minimum design criteria for the modification and construction of wastewater collection and treatment systems constructed within City of Goodyear public right-of way or easements. It is intended for general use in the planning, design, and plan preparation processes.

6.1.2 General Information

A. Ordinance Requirements

1. The City requires sewer lines to be installed along the entire length of property line frontage of the property to be developed whenever future extension of the line is possible. The property line frontage is that portion of the property along a public right-of-way. If a parcel to be developed has more than one property line frontage, the City will require a sewer line to be installed along all frontages.
2. Upon development of property for which City water or sewer service is available, the developer shall submit a plan for the sewer system prepared by a professional engineer licensed in the State of Arizona.
3. The developer shall install, at his expense, all on-site and off-site improvements necessary to serve his development. This includes payment of all required development fees.
4. The City may require users who have a non-residential discharge to monitor their discharges and obtain an Industrial Waste Discharge Permit.
5. For more specific information on ordinance requirements, review of the Goodyear Revised Code is recommended.

B. City Policies

1. Sanitary sewers shall be designed to serve the ultimate population density expected in the tributary area. The design must be in conformance with the current City-approved Wastewater Master Plan; and, as such, shall take future connections into consideration.
2. Sewer lines shall not be privately owned if future connection to said sewer lines will be necessary to serve adjacent parcels.

3. Private sewer lines shall meet Maricopa County Health Department and City of Goodyear Building Inspection requirement for approval. Privately owned and maintained sewer lines shall not be located within the street right-of-way or a Public Utility Easement (PUE). On-site sewer collection systems within commercial shopping centers shall be designed as private systems.
4. Private Sewer Companies
 - a. Portions of Goodyear's municipal service area are provided sewer service by private sewer companies. Private companies are those defined by Arizona Revised Statutes.
 - b. Modifications or construction of sewage collection systems within private sewer company franchise areas shall be reviewed by the City and the subject company. The City of Goodyear shall review private sewer systems within the City limits to City of Goodyear current standards. The applicable review fees shall be paid and a note placed on the drawings delineating operation and maintenance responsibilities. The City cannot provide sewer service within private sewer company franchise areas.
5. EPA Regulation

The City is required by the USEPA to develop and implement a program to control discharges that might harm the Publicly Owned Treatment Works (POTW). The program establishes local discharge limits for non-residential users and provides for a permitting process based on the users discharges and type of business. Details of the program and requirements are found in the Goodyear Revised Code. Specific information may be obtained by calling the Wastewater Operations Division at 932-1637.

C. Sewerage System

1. All developments are required to connect to the City's sewerage system. On-site disposal systems are not allowed. Exceptions are made only with the written approval of the City Engineer.

2. The City's sewerage system includes six (6) classifications of sewer lines which are determined by use. These classifications are:
 - a. Building Sewer - In plumbing, the extension from the building drain to the public sewer or other place of disposal; also called house connection.
 - b. Branch Sewer - A sewer that receives wastewater from a relatively small area and discharges into a main sewer serving more than one branch sewer area.
 - c. Lateral Sewer - A sewer that discharges into a branch or other sewer and has no other common sewer tributary to it.
 - d. Submain Sewer - A sewer which the wastewater from two or more lateral sewers is discharged and which subsequently discharges into a main, a trunk, or other collector.
 - e. Main Sewer/Trunk Sewer - In larger systems, the principal sewer to which branch sewers and submains are tributary. In small systems, a sewer to which one or more branch sewers are tributary. In plumbing, the public sewer to which the house or building sewer is connected.
 - f. Interceptor Sewer - A sewer that receives flow from a number of transverse sewers or outlets, and conducts such waste waters to a point for treatment or disposal.
3. All developments shall provide for trunk, collector, and service lines as required to provide sewer service for not only the individual development but for the ultimate service area, as deemed necessary by the City Engineer.
4. Sewer lines shall be sized to accommodate their ultimate service area. The minimum size line for the public mains is 8 inch diameter.
5. Public sewage lift stations shall not be permitted in the City of Goodyear. Under unusual circumstances when a lift station is the only means of the property being sewered, consideration shall be given by the Public Works Director, or his designee, on a case by case basis.

6. A sewerage feasibility report, prepared by a registered civil engineer, shall be required to determine that the current line has the capacity for connection and that the minimum slopes will allow for the installation of services. The cost of said report shall be the responsibility of the developer.
7. All sewers shall be a minimum of 8 inch diameter. Larger mains may be required dependent upon the maximum flows anticipated with full development of the ultimate service area. The following data may be used as a general guide for planning purposes. Additional engineering studies may be required in individual cases to verify validity of these general capacities:
 - a. A maximum of 120 acres of combined commercial and residential property may drain into any 8 inch line.
 - b. A maximum of 250 acres of combined commercial and residential property may drain into any 10 inch line.
 - c. A maximum of one square mile may drain into a 12-inch line with the written approval of the City Engineer.
8. ADHS Bulletin 11 shall apply to all City sewer lines.

6.1.3 Technical Design Requirements

A. Sewer Lines

1. Materials and Details

In selecting pipe material for sewers, consideration shall be given to the chemical characteristics of the wastewater, especially in industrial waste flow areas, the possibility of septicity, exclusion of infiltration, external and internal pressures, abrasion and similar problems encountered with the established grades.

 - a. Standard materials and details for collector and service lines, over 15 inch, within the rights-of-way, shall be of vitrified clay pipe (V.C.P.). Materials and details for trunk sewer mains of 24 inch diameter or larger will be considered individually. Plastic pipe, 8-inch through 15-inch is allowed for installation within the right-of-way.
 - b. No public sewers other than service taps shall be less than eight (8) inches in diameter unless permission is received in writing from the Engineering Department.

- c. Pipe material shall not change between manholes.
- d. Where standard strength pipe is not structurally sufficient, or when proper cover cannot be maintained, additional strength must be obtained by using extra-strength pipe, special bedding specifications, or special construction methods.
- e. All types of pipe materials used in design shall have established ASTM, ANSI, or NSF standards of manufacture or seals of approval and shall be designated for use as sewer pipe.
- f. Pavement replacement type and compaction type shall be indicated per MAG Standard Details and Specification on each sheet.

2. Hydraulic Design

- a. Slopes shall be sufficient to maintain velocity of 2 feet per second in the sewer, based upon Manning's Formula, using an "n" value of 0.013. To prevent abrasion and erosion of the pipe material, the maximum velocity shall not exceed 9 feet per second.
- b. Hydrogen sulfide problems continue to be a concern, and therefore must be analyzed in the Design Report and be provided for in the design of the system where required.
- c. All velocities should be analyzed under peak flow conditions.
- d. The following table indicates the minimum slopes generally considered necessary to obtain minimum 2 feet per second. Exceptions require the written approval of the City Engineer. In no case shall velocities greater than 9 fps be allowed.

TABLE

Minimum Slopes for Sanitary Sewers
(n = 0.013)

Size	Minimum Design Slopes
4 in. Building Conn.	0.0200 ft. per ft.
6 in. Building Conn.	0.0100 ft. per ft.
8 in. Building Conn.	0.0034 ft. per ft.
10 in. Building Conn.	0.0024 ft. per ft.
12 in. Building Conn.	0.0020 ft. per ft.
15 in. Building Conn.	0.0016 ft. per ft.
18 in. Building Conn.	0.0012 ft. per ft.

3. Location within the right-of-way
 - a. All public sanitary sewer lines shall be located within the dedicated street right-of way.
 - b. Sewer lines shall be located per Details G-3132 and G-3136, as applicable.
 - c. All sewers shall be aligned parallel to the property lines or the street centerlines, or as close to parallel as possible.
 - d. Minimum horizontal distance from the sewer line to another underground utility shall be 6 feet.
4. Easement Requirements
 - a. No sewer lines shall be installed in an easement unless the Public Works Department has approved in writing the placement of the line(s) in an easement(s) and the property owner has granted the necessary easement(s) and right(s)-of-way.
 - b. If approved, sewer lines outside of public rights-of-way shall be placed in easements not less than twenty (20) feet wide, or at the discretion of the Public Works Director, or his designee. The sewer lines shall be accessible from a public right-of-way.

- c. Easements larger than twenty (20) feet in width may be required if other utilities are also located in the easement or if additional area is needed for maintenance equipment access due to the size and/or depth of the line(s). Easements shall be free of obstructions, shall not be located in a fenced area, and shall at all times be accessible to City service equipment such as trucks, backhoes, etc. Areas in question shall be approved in writing by the Public Works Department.
 - d. Easements shall be dedicated prior to any construction.
- 5. Pipe Locations and Separations
 - a. Separation of Water and Sewer Lines
 - (1) Caution should be taken in the design and construction of sewer lines to protect all water supplies from wastewater contamination. To minimize the potential of contamination, the engineer shall design the horizontal and vertical separation of water and sewer lines in accordance with MAG.
 - b. Separation from Gas Lines
 - (1) The minimum horizontal distance from a sewer line to a gas line shall be six (6) feet wall to wall.
 - c. Separation from Storm Drains and Culverts
 - (1) Sewer lines crossing less than two (2) feet below a storm drain or culvert, or under large structures such as box culverts and bridges may require additional protection such as the use of ductile iron pipe.
 - (2) Sewers crossing over storm drains and culverts must be a minimum of one (1) foot above.
- 6. Cover and Depth
 - a. All laterals shall have a minimum four (4) foot cover measured from finished ground at the property line or easement line. In no case shall sewer lines be installed

with less than four (4) feet of cover over the top of the pipe.

- b. All trunks, mains, or branches shall have a sufficient depth to serve the ultimate drainage area with a minimum cover of 6 feet.
- c. When a sewer line crosses an irrigation ditch, at least 4-foot cover between the flow line of the ditch and the crown of the sewer shall be maintained. If this condition cannot be met, the crossing shall be made according to the directions of the City. Permits shall be acquired in the name of the City.
- d. Where cover is less than 3 feet (due to topography such as canals, washes, etc.) a 6 inch thick concrete cap shall be constructed in place over the sewer line. This cap shall extend not less than 2 feet on either side of the outside of the barrel of the sewer pipe and shall extend 5 feet beyond the limits of the canal, wash, etc. This is allowed only with the written approval of the City Engineer.
- e. Sewers shall be installed at a depth sufficient to ensure gravity drainage of wastes from each service. Sewer design shall ensure adequate drainage from the ultimate drainage area, and shall allow for the future extension of service to adjacent parcels.
- f. All sewers shall be designed to absorb superimposed live loads and backfill overburden without damage to the pipe material, and without adversely affecting the hydraulic characteristics of the pipe. The engineer shall specify minimum depths of cover to be provided during the construction of roadways or other facilities affecting cover over the sewer line.

7. Intersecting Lines

- a. When the size of pipe changes, the crowns shall match.
- b. Manholes with the through line having a change of direction of more than 30 degrees shall have a minimum 0.10 foot drop through the manhole.
- c. Manholes with a line intersecting the through line: the intersection line invert shall be 0.10 foot above the flow

line of the through line. The lines shall intersect at no more than a 90-degree angle.

8. Curved Sewers

- a. Horizontal curvilinear sewers will not be accepted.

9. Tie-in to Existing System

- a. Construction plans shall call for contractor to tie-in new work to the existing, active system only after completion of the new work and specific approval of the engineering inspector to make the tie-in.

10. Design Flows

- a. In the absence of flow data provided by the designer, new domestic sewage systems shall be designed in accordance with the following:
 - (1) Sewers eight (8) to twelve (12) inches in diameter shall be designed with peak capacities, when flowing full, of not less than four hundred (400) gallons per capita per day (gpcd).
 - (2) Sewer mains larger than twelve (12) inches in diameter shall be designed using one hundred five (105) gpcd and a peaking factor developed from "Harmon's Formula":
 - ◆ $Q_{max} = Q_{avg} [1 + 14/(4+P^{1/2})]$
 - ◆ WHERE: $P = \text{Population}/1,000$
 - ◆ Commercial flows should be based upon known regional data, or accepted engineering reference sources, approved by the City.
 - ◆ Density data to be used in sewer design*:
 - Single family units
2.5 persons/unit

- Multi-family units:
 - * Townhouse/patio homes
2.9 persons/unit
 - * Apartment
2.5 persons/unit

◆ *Subject to regional variations as approved by the City's planning program.

B. Manholes

1. Materials and Details

- a. All manholes shall be per MAG Standard Details and Specifications.
- b. If the manhole is more than ten (10) feet deep, or the line is over twelve (12) inches in diameter, the manhole shall be five (5) feet in diameter. Ladders with cast-in Plastic/fiberglass anchors will be an acceptable alternative to steps.
- c. The flow channel through the manhole shall be steel-trowel finished to conform in shape and slope to that of the sewers. The manhole shelf shall be brush or broom finished, with a slope of one inch per foot. The manhole bottom should be filleted to prevent solid depositions and channeled to ensure satisfactory flow to the lower invert.
- d. Manholes should be protected from storm drainage and flooding conditions whenever possible. Sewers will not be allowed in washes or drainage areas unless otherwise approved in writing by the City's Wastewater Operations Division. When designs specify manholes to be located in washes or drainage areas, bolted water-tight manhole covers or water-tight manhole inserts shall be used to prevent inflow. The manhole shall be a monolithically poured structure designed such that infiltration or exfiltration cannot occur. Providing for the elimination of infiltration and/or exfiltration in washes is the engineer's responsibility in the design of the system.

2. Spacing

- a. Manholes are required at all changes in grade, pipe size, all changes in alignment, and to ensure the sewer line does not cross the street centerline. The horizontal angle formed between the two lines shall not be less than ninety (90) degrees in the direction of flow.
- b. Maximum manhole spacing shall be:
 - (1) 400 feet for 8 inch to 15 inch sewers
 - (2) 500 feet for 18 inch to 60 inch sewers
 - (3) 500 feet for sewers over 60 inch.
- c. Manholes in City streets must be located near the center of a traffic lane, rather than on or near the line separating traffic lanes. Manholes should not be located in bike trails, equestrian trails, sidewalks, or crosswalks.
- d. A clean out or manhole shall be placed on the upstream end of lines if the line will not be extended. The spacing to a cleanout from the last manhole shall not exceed 150 feet. Cleanouts must be placed on the end of all line extensions to allow for cleaning and televising of lines.
- e. If there are services between the last manhole and the end of the line, a cleanout shall be required on the end of a line that may be extended in the future. If there are no services between the last manhole and the end of the line, then the end of the line shall be plugged and an additional plug shall be placed in the upstream side of the last manhole.
- f. Manholes on boundaries of the subdivision or improvement district shall have stubs with shaped inverts in appropriate directions for future connections.
- g. Centerline Station and offset shall be shown on all manholes.

3. Intersecting Lines Within Manholes
 - a. Manholes with lines intersecting at angles more than 30 degrees shall have a minimum 0.10 foot drop across the manhole.
 - b. When sewer lines of differing sizes enter the same manhole, the upstream pipe shall not have its crown lower than the crown of the downstream pipe.
 - c. In large trunk lines, invert at junctions should be designed to maintain the energy gradient across the junction and prevent backflow.
4. Drop Manholes
 - a. If the difference in invert elevations between inflow and outflow sewers exceeds twelve (12) inches, a drop connection shall be installed in accordance with MAG standards, Type A, Detail No. 426. The manhole bottom shall be filleted to prevent solids deposition.
5. Monitoring Manholes
 - a. The City shall determine whether or not a sewer will be required to have a monitoring manhole to test the flow and composition of their sewage. As a general rule, sewer uses with a projected water consumption of 25,000 gallons per day or a discharge of a categorical industrial nature or as otherwise required by the City's Wastewater Operations Division, shall be required to have a monitoring manhole.
 - b. On sewer lines with diameters smaller than six (6) inches, monitoring manholes shall be standard MAG manhole with a straight channel and no taps or bends for two (2) pipe lengths upstream and one (1) pipe length downstream.
 - c. Design details for monitoring manholes on sewer lines six (6) inches or larger or with a peak flow greater than forty (40) gpm shall be approved by the City.
 - d. Monitoring manholes shall be located in a twenty (20) foot PUE which extends from the manhole to the existing public sewer. The monitoring manhole shall

be accessible at all times for monitoring crews and vehicles.

C. Taps

1. Materials and Details

- a. New sewer taps shall be per MAG Standard Details 440 and 441.
- b. The maximum number of taps into manholes shall be three (3) into a manhole in a cul-de-sac and two (2) into a manhole in all other situations. However, no tap is allowed into a manhole against incoming flow through the manhole. Sewer service line inverts shall be a maximum of one and one-half (1.5) feet above the crown of the outflow pipe.
- c. A 3 foot minimum separation between service taps is required.
- d. All taps shall be dimensioned and stationed using the closest downstream manhole as Station 0 + 00. Typical dimensions to water service lines shall be shown.
- e. Taps installed for future connection shall be marked.
- f. All taps, when installed, must be perpendicular to the lateral. Taps may be at an angle only if located into a manhole, but the flow line of the sewer service line shall not be more than four (4) inches below the crown of the line to be tapped.
- g. No taps will be made directly into sewers larger than 15 inch. Such taps must be into a manhole.
- h. Plans shall be reviewed by the design engineer for backflow prevention valves which are required where finish floor elevations are below both upstream and downstream manhole rim elevations.
- i. Grease, oil, or sand interceptors which are acceptable to the City shall be provided for laundries, restaurants, automobile service facilities, and other facilities when, in the opinion of the City, they are necessary for the proper handling of liquid wastes. Interceptors shall be supplied and maintained by the owner.

2. Sizes

- a. Tap sizes for single family residential developments shall be 4 inch. A 4-inch diameter tap shall be provided for each platted lot.
- b. Commercial lots with buildings shall have 6 inch minimum taps and provide service adequate for discharge. Commercial lots without buildings shall have no taps unless requested by owners, then only 6-inch minimum taps or larger shall be allowed.
- c. Multi-family developments shall have a minimum 6-inch tap.
- d. All taps larger than 6 inch require the installation of a manhole.

3. Location

- a. Taps shall be located so as to avoid conflicts with driveway locations.
- b. Proposed tap locations shall be shown on all plans and shall be changed in the field by the City only.
- c. Because water lines are located behind the curb in many locations, conflicts with sewer service lines are possible. Sewer line should be designed to allow sewer service lines to pass under water mains behind the curb with twelve (12) inches of clearance to minimize potential health hazards.
- d. When it is not possible to maintain sufficient clearance, or the sewer service will pass over the water main, the sewer service must be encased in concrete of six (6) inches minimum thickness, three (3) feet from each side of the crossing, or ductile iron pipe must be used for the same distance.

6.1.4 Sewage Pump Stations

A. Site Selection

1. In selecting a site for a sewage for a sewage pumping facility consideration should be given to:
 - a. Accessibility
 - b. Drainage Characteristics
 - c. Visual Impact
 - d. Function and Design Constraints
2. The potential for flooding should be considered when selecting a pump station location. The station's equipment shall be protected from damage and remain operable during a 100-year flood.

B. Pump Station Design

1. Sewage pump station requirements are provided by the Arizona Department of Environmental Quality (ADEQ) and are published in their Engineering Bulletin No. 11. Additional requirements specific to the City of Goodyear can be obtained from Water Operations before beginning design. At a minimum, telemetry, dual pumps, generator, three phase power, and odor control will be required.
2. It is recommended that prior to the preparation of construction drawings that a preliminary or basis of design report be prepared and submitted to the City for acceptance. The preliminary report should outline the type of equipment and controls proposed for the station. A final design report prepared by a registered professional engineer licensed in the State of Arizona must accompany all pump station design drawings.

C. Sewer Lift Station Design Standards

1. There shall be a minimum of 2 pumps at each site. Pumps shall be capable of passing 2-1/2" solids and equipped with stainless steel motor shafts.
2. Check valves shall be silent closing type and located in a separate vault.
3. Three-phase 480 Volt power shall be used where available.

4. Field prints shall include all electrical information.
5. Phase protection shall be provided for all three-phase motors and pumps.
6. An hour meter shall be provided for each pump.
7. Pump failure indicator lights shall be provided on the control panel and the exterior of the station.
8. An access hatch and permanent ladder shall be installed in the wet well.
9. All pump station control panels shall be designed for future installation of a telemetry system.
10. Only submersible pumps shall be used.
11. Approved submersible pump stations shall be on the approved list at Public Works.
12. A minimum of three (3) sets of the operation and maintenance manuals shall be prepared and provided to the Water Operations Division prior to the final inspection.
13. Force main shall be identified as such with magnetic tape one (1) foot above the pipe.
14. Clean outs shall be installed per section 6.1.4.D.4.
15. Lift station shall be located a minimum distance of one hundred (100) feet from the nearest home. A block wall shall be constructed around the perimeter of the lift station site.
16. Odor control measures must be identified in the design concept report and incorporation into the design.
17. Provide spare parts as recommended by the manufacturers.
18. Electrical specifications information is to be provided on field prints as follows:
 - a. Electrical specifications
 - b. Size of conduits
 - c. Size and type of conduits
 - d. Size and type of over-current protection for all disconnects

- e. Phase protection for all three- phase motors and pumps
- f. Floats shall be used for all controls and alarms.
- g. Failure indicator lights on control panel
- h. Hour meter totalizer for each pump
- i. Flashing light to warn of pump failure
- j. Alarm circuitry to one terminal board for telemetry
- k. No electrical connections in wet well
- l. NOTE: It is recommended that designers coordinate their pump station design with the Water Resources Department prior to final plan preparation (See Section 5.1.1.F.3 of this manual.)

D. Force Mains

- 1. Velocity Requirements
The velocity of flow in the force main shall be between 4 and 6 fps.
- 2. Materials of Construction
All types of pipe materials used in design of force mains shall have established ASTM, ANSI, AWWA, and NSF standards of manufacture or seals of approval and shall be designated as pressure sewer pipe. Force mains shall be identified as such with marking tape one foot above the pipe.
- 3. Air Release Valves
Air release valves designed for sewage shall be provided on force mains at all peaks in elevation. See Detail G-3440.
- 4. Cleanouts
Two-way cleanouts shall be provided every eight hundred (800) feet or one-way cleanouts every four-hundred (400) feet.
- 5. Water Line Separation
 - a. Where a force main crosses a water main or transmission line, the force main shall be constructed of ductile iron pipe for a distance of ten (10) feet on each side of the water line.
 - b. For details regarding force main discharge into a manhole, refer to Detail G-3442.

6. The minimum separation between force mains and water lines shall be two (2) feet wall-to-wall vertically and six (6) feet horizontally.

7. Testing

a. Prior to issuance of a Certificate to Operate, all force mains shall be pressure tested. Preparatory to testing, the section of the pipeline to be tested shall be filled with water and placed under a slight pressure for at least forty-eight (48) hours. The pipeline shall then be brought up to fifty (50) psi over or to one hundred twenty-five (125) percent of working class pressure, whichever is greater, and shall be maintained on the section under test for a period of not less than four (4) hours.

b. Accurate means shall be provided for measuring quantity of water required to maintain full test pressure on the line for the test period, which shall not exceed:

(1) $L = [JD \sqrt{(Pt)}] / 4500$

(2) Where:

- ◆ L = Maximum allowable leakage in gallons per hour for the section of pipeline tested
- ◆ J = number of joints in length tested
- ◆ D = diameter of pipe in inches
- ◆ Pt = test pressure in psi

6.1.5 Wastewater Treatment

A. Treatment Plants

The subject of wastewater treatment plant design is beyond the scope of this design booklet. The engineer is urged to contact the Maricopa County Environmental Services Department, and the City of Goodyear Wastewater Operations Division for further information pertaining to the development of wastewater treatment facilities within Goodyear.

B. Septic Systems

1. When sewer service is not available, a temporary septic system may be allowed with the approval of both the City of Goodyear and the Maricopa County Environmental Services Department.
2. A “dry” sewer line shall be installed along the entire length of the property line frontage. The property line frontage is that portion of the property along a public right-of-way. If a parcel to be developed has more than one property line frontage, the City will require a sewer line to be installed along all frontages.
3. The operation and maintenance of septic systems are the responsibility of the owner. The City of Goodyear will not accept any septic system for operation and maintenance.

C. Reclaimed Water

Wastewater Reclamation and Advanced Treatment

The City’s current Wastewater Master Plan calls for the development of regional wastewater reclamation facilities. Reclaimed water is to be used to satisfy the demand for water to irrigate golf courses and parks. Reclaimed water in excess of the irrigation demand shall be provided advanced treatment and stored underground for subsequent recovery. Contact the City’s Wastewater Operations Division for more detailed information on this plan.

6.1.6 Plan Preparation

A. General

1. Plans shall be prepared per the guidelines in Chapter 2 - Construction Plan Requirements.
2. Notes which apply to construction on the City of Goodyear’s sewer system are required on each set of improvement plans which include work on the City’s sewer system or a sewer system which is to be dedicated to the City. These notes are provided in Section 2.1 of this manual.

B. Plan Requirements

1. The following paragraphs highlight improvement plan requirements pertaining to the preparation of sewer improvement plans which are to be submitted to the City for approval.

- a. Sewer line stationing shall be along the center line of the pipe.
- b. Concrete encasement shall be shown in both plan and profile. The beginning and ending stations of the encasement shall be called out.
- c. If a line is to be connected to an existing system, the following note shall be placed on the plans:
“Contractor shall verify the location of the existing sewer line before proceeding with trenching.”
- d. Both slope and elevation shall be shown on all proposed sewer main stubs (profile not required).
- e. Where sewer lines cross water lines, storm drains, or drainage culverts, the relationship shall be shown in both plan and profile and minimum separations shall be called out.
- f. For permitting purposes, quantities for all items of work within public rights-of-way and public easements shall be included on the cover sheet of the plans.
- g. Sewer service line invert elevations shall be called out for all plans showing sewer service line construction.
- h. The drawings shall show all utility locations, sizes, easements, rights-of-way, and other structural features of the sewer for current and future building construction.
- i. Lift station details shall show all invert elevations, structural elevations, existing and finished grades, control setting elevations, structural design of wet wells and dry wells, valves and piping, surge control devices, pump suction and discharge details, and any other details which will provide a clear understanding of the design.
- j. Plans and profiles of force mains shall show size, invert and grade elevations, materials of construction, utility location, and any other details which define the force main construction requirements.

- k. Private sewer lines shall be noted as such on plans. The responsibility for operation and maintenance should also be called out.
- l. Easements of record shall be noted and shown in plan view including docket and page numbers or recorder's number.
- m. All plan documents for sewers and/or wastewater treatment works shall be prepared by a registered professional engineer licensed in the State of Arizona under the provisions of ARS 32:141-145.
- n. There are additional requirements for the preparation of improvement plans in the City of Goodyear. The additional requirements are presented in Section 2.1 of the City of Goodyear Design Standards and Policies Manual.

C. Design Reports

- 1. A design report shall be required. The design report serves to present necessary information concerning design assumptions and computation.
- 2. The objective of the report is to provide background information for review of the project. All proposed lift station designs shall be accompanied by a signed and sealed design report.
- 3. Record Drawings
Record drawings are required for all sewer system improvements. Upon approval of the improvement plans, the developer shall provide the City of Goodyear with As-Builts.

D. Reviews and Approvals

- 1. All improvement plans which include work within the City of Goodyear shall be submitted for review and approval by City staff. Plan review submittals are made to the Planning and Community Development Department. Plan review fees must be paid at the time of plan submittal.
- 2. Maricopa County Environmental Services Department approval is required prior to City approval. No permits for public sewer installation will be issued until the owner/developer has provided the necessary easements and

rights-of way. The instruments of dedication must be approved by the City of Goodyear and recorded at the Maricopa County Recorder's Office.

E. Master Plans

1. When required, a Master Wastewater Plan and report shall be prepared in accordance with the City's Design Standards and Policies by a registered professional engineer who is licensed to practice in the State of Arizona. The master plan and report shall address, but not be limited to, the following:
 - a. The Master Plan will become the basis for a Water and Wastewater Service Agreement between the developer and the City of Goodyear when such agreement is required by the City. This agreement will specify terms and requirements for water and wastewater service to the development. The introduction to the report should state this.
 - b. All development projects shall be responsible for determining their specific wastewater system needs. Service for proposed developments shall not be provided at the expense of existing customers and the wastewater master plans shall verify this.
 - c. Adequate sewer capacity must be shown for the development. In addition, sewer system calculations or a sewer model shall be used to determine the required on-site and off-site facilities such as sewer lines, lift stations, and force mains necessary to serve the project.
 - (1) If no change in zoning is proposed, then the wastewater system for the project must be analyzed to the point of discharge to an existing sewer which has sufficient capacity to serve the project and which is included in the current City Wastewater Master Plan.
 - (2) If the proposed development requires a change in zoning which increases density or proposes a sewer different from the City's existing Wastewater Master Plan.
 - (3) Calculations should be based on Manning's equations using a Manning's "n" of 0.013 and

the invert elevation and pipe diameters of all existing and proposed pipes.

- (4) Waste water flows generated within the development shall be calculated as specified in Section 6.1.3.A.10 - Design Flows.
 - (5) Off-site calculations shall be based on a sewer sub-basin which shall be shown on an accompanying map. The sub-basin shall include all areas upstream of the development and downstream of the development to the next interceptor sewer. An interceptor sewer shall be defined as 15-inch diameter or larger.
 - (6) Off-site wastewater flows shall be as specified in the City's current Wastewater Master Plan.
 - (7) A computer disk containing all calculations shall be submitted along with the master plan report. Common spread sheet formats compatible with Lotus 1-2-3 are acceptable.
- d. Compliance with the current City Wastewater Master Plan for the respective area.
- e. Each Master Plan must include a map showing the following:
- (1) All proposed on-site and off-site facilities; including, but not limited to, interceptors, sewer lift stations, and force mains.
 - (2) Proposed street locations, parcel boundaries, and proposed lots within each parcel.
 - (3) Contour lines at two (2) foot intervals showing the elevation of the land surface. If drainage requirements will require extensive grading, then finish grade should be shown. Sufficient information must be provided to evaluate pipe cover.
 - (4) A separate area location map shall be provided showing existing and proposed streets, as well as existing parcels surrounding the project to a distance of not less than one (1) mile from the

exterior boundaries of the project. Assessor's maps can provide the information required to prepare these composite maps.

- (5) The scale of all maps must be sufficient to show all required information clearly
- f. All sewer lines which cross golf courses or other open areas shall do so within established roads. If dedicated roads are not practical, then crossing must be within an easement twenty (20) foot wide, or at the discretion of the Public Works Director, or his designee. All other sewer lines outside dedicated rights-of-way shall be on easements not less than twenty (20) feet wide, or at the discretion of the Public Works Director, or his designee. No walls shall cross these easements.
- g. The Wastewater Master Plans must show compliance with the Goodyear Revised Code to construct pipelines, if not already in place, across all dedicated frontages of the development. If the slope of the existing ground is such that other properties fronting the sewer would benefit, then this condition shall be justified in the report.
- h. A construction schedule shall be included in table format for all wastewater related construction required to serve the development, per signed zoning or other agreements.